

Phylogenetic Tree Practice

Method 1: Using Mutation Rates

DNA must be replicated for it to be passed onto new generations. Even though there are repair and proof-reading mechanisms, sometimes mutations happen that are not corrected. The rate at which mutations occur is the same in most organisms. Therefore, by comparing & contrasting their DNA sequences, we can infer who is most closely related to whom.

The sequences below are fictional; if this were a true sequence analysis, the sequence would be much longer and analyzed by a computer. Also, the sequence must code for the same thing so that the differences among the sequences would only be due to mutations.

Problem 1: You wish to compare the sequences of 4 organisms (A, B, C, D) to their ancestor as shown in the table below.

Organism	DNA Sequence
Ancestor	ATTGCGAGCCTTAGTCGATTAGCTTCGCCCAATGGATCGATGCTAGTCA
A	ATTGGGTGCCTTAGTCGTTTAGCTTCGCCCAATCGATCGATGCTAGTCA
B	ATTGCGTGCCTTAGTCGATTAGCTTCGCCCAATGGATCGATGCTAGTCA
C	ATTGGGTGCCTTAGTCGTTTAGCTTCGCCCAATCGATCGATCCTAGTCA
D	ATTGCGTGCCTTAGTCGTTTAGCTTCGCCCAATGGATCGATGCTAGTCA

Steps:

1. Note the ancestral specie's sequence.
2. The next oldest species will have the next fewest mutations while the newest species will have the most mutations.
3. Scan the sequences for changes from the ancestral species.
4. Construct the tree from oldest to newest using proper scaling.

Name _____ Period _____

Problem 2: You wish to compare the sequences of 6 organisms (A, B, C, D, E, F) as shown in the table below. **Organism A** is known to be the ancestral species of all the others. Construct a cladogram showing the species from oldest to newest.

Organism	DNA Sequence
A	TAAGCAGTTCGAAAATTGCTCGATGACCATGACATGGACAATAGCCCTC
B	TAAGCAGTTCGAAAATTTCTCGATGACCATGACATGGACAATAGCCCTC
C	TAAGCACTTCGACAATATCTCGATGACCATGAGATCGACAATAGCGCTC
D	TAACCACTACGACAATATCTCCATGACGATGAGATCGACATTAGCGCTC
E	TAAGCACTACGACAATATCTCGATGACGATGAGATCGACAATAGCGCTC
F	TAAGCACTTCGAAAATTTCTCGATGACCATGAGATGGACAATAGCGCTC

Construct a tree using proper scaling.

Name _____ Period _____

Method 2: Using Features & Processes

Using physical or chemical features requires you to differentiate between those reflecting homology versus those reflecting analogy.

	Euglena	Rose	Planaria	Fly	Pitcher Plant	Wasp	Poison Ivy
Multicellular		x	x	x	x	x	x
Heterotroph			x	x		x	
Autotroph	x	x			x		x
Wings				x		x	
Extracellular enzyme production			x	x	x	x	
Hermaphrodite		x	x		x		
Flowers		x			x		x
Toxin Produced						x	x

Construct a tree using the data, keeping in mind phylogenies are representative of homology, not analogy.